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INSTRUCTIONAL CHANGES AMONG TEACHER GRADUATES OF A COURSE ON AUTOINSTRUCTIONAL PROGRAMING.

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A SURVEY WAS MADE OF THE GRADUATES OF PROGRAMING COURSES AT THE UNIVERSITY OF ROCHESTER TO DETERMINE WHAT INSTRUCTIONAL CHANGES OCCURRED AMONG THOSE TEACHERS WHO WERE TRAINED IN THE CONSTRUCTION OF PROGRAMED LEARNING SEQUENCES. ALSO SURVEYED WAS A RANDOM SAMPLE OF TEACHERS WHO HAD RECEIVED INFORMATION ABOUT, BUT NOT EXPERIENCE IN, PROGRAMING. EXPERIMENTAL SUBJECTS (200) WERE SELECTED FROM PROGRAMING CLASS REGISTRATION LISTS. A RANDOM SAMPLE OF 70 TEACHERS (CONTROL SUBJECTS) WAS SELECTED FROM ATTENDANCE LISTS OF SUMMER INSTITUTES ON PROGRAMING. MAILINGS OF THE SURVEY INSTRUMENT WERE UNDERTAKEN WITH A 75 PERCENT RETURN. FIFTY-NINE PERCENT OF THE EXPERIMENTAL AND 22 PERCENT OF THE CONTROL RESPONDENTS REPORTED SOME USE OF PROGRAMING WITH THEIR STUDENTS. ALSO, 53 PERCENT OF THE EXPERIMENTAL GROUP AND 24 PERCENT OF THE CONTROL GROUP REPORTED THE USE OF PROGRAMED MATERIALS WITH INDIVIDUAL STUDENTS. CONCLUDING STATEMENTS INDICATED THAT CLASSROOM TEACHERS WHO HAVE BEEN TRAINED IN PROGRAMING HAVE BEEN FOUND TO MAKE SIGNIFICANTLY GREATER USE OF PROGRAMED MATERIALS. (HB)

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INSTRUCTIONAL CHANGES AMONG TEACHER GRADUATES OF A COURSE ON AUTO-INSTRUCTIONAL PROGRAMMING

Cooperative Research Project No. S-189 (OE-5-10-189)

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I. THE PROBLEM

While research on programmed learning has expanded rapidly over the past several years, the general utilization of learning programs in public school classrooms has not increased as greatly as might have been expected. One of the most critical factors, obviously, is the lack of knowledge concerning programmed instruction among classroom teachers themselves. Those who graduated from teachers' colleges prior to 1958 had no acquaintanceship with programming in their formal training. Most of those who graduated since, or who are still in the preparatory stages, have received, at best, a limited experience with instructional programs. Of those who have encountered programs, fewer still have had instruction in the actual process of constructing programmed materials.

In an effort to acquaint the teachers with the possibilities inherent in programmed instruction, a great deal of activity has taken place in the form of in-service meetings, orientation programs, and short courses on programmed learning. In a relatively few institutions, however, there has emerged a concentration on courses or workshops intended to develop programming skills in the teacher. This approach is based on the belief that only by direct involvement in the developing programming process can the teacher become an effective agent of change in the school situation.

The problem with which this survey deals is the determination of whether teachers who have become highly involved in the development of a programmed sequence do, in fact, become more effective change agents than teachers who have received cognitive information only about programming when both groups return to their school environment.

II. BACKGROUND TO THE PROBLEM

In January of 1961, the University of Rochester established the first collegiate course in programming instructional materials. The rationale for this course was to give the teacher first-hand experience in the theory, development, and utilization of self-instructional programs. (More than 250 classroom teachers representing a wide band of instructors from primary teachers to college professors and industrial educators have attended the course since its inception.)

The reasons for this approach have been stated succinctly, "Until a teacher has done some programming and has demonstrated to himself that he can control this new pedagogical method, he would be unlikely to use it with his students. If he should use it without previous personal experience, he probably would not do so to best advantage."[1]

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[1]Lysaught, J. P. and C. M. Williams. A Guide to Programmed Instruction. New York: John Wiley & Sons. 1963. p 23.

John Barlow, former head of the self-instructional project at Earlham College, has agreed emphatically with this approach in stating, "I have some real reservations as to the over-all profit to the student and to education in instances in which a teacher who has never constructed a program and does not understand the process involved in them, uses a program for his students that someone else has prepared for him."[2]

This same emphasis on the necessity for involving the teacher in the actual process of programming, rather than in an appreciation of it is exemplified in the writings of Geis,[3] Komoski,[4] Hughes,[5] and others. A search of the literature has failed to reveal a single author who takes exception to the general acceptance of the idea that programming experience should be beneficial to the encouragement of actual instructional change within the teacher's classroom. Eigen does point out, however,

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[2]Barlow, J. A. Guest Editorial in Programmed Instruction. Vol. 1, No. 1. May, 1961. p 3.

[3]Geis, G. L. "Program Preparation" in Teal, G. E. (Ed.) Programmed Instruction in Industry and Education. Stamford, Conn.: Public Service Research. 1963.

[4]Komoski, P. K. "Programming by Teachers for the School Curriculum." New York: The Center for Programed Instruction. 1961. (offset).

[5]Hughes, J. L. Programed Instruction for Schools and Industry. Chicago: Science Research Associates. 1962.

that while ". . . programmed instruction has the potential of contributing a great deal, but little has been done as yet."[6]

III. OBJECTIVES OF THE STUDY

The objective of this study was to survey the graduates of the programming courses at the University of Rochester and to determine in operational terms what instructional change has occurred among those teachers who have been trained to some degree in the construction of programmed learning sequences. In order to provide a benchmark for assessing these findings, we also decided to survey a random sample of teachers who had received information on, but not experience in, programming. The responses would then be compared.

Because this is a descriptive study, questions rather than hypotheses were generated. We wished to learn:

A. How many of the teachers actually administered programs to their own students?

B. How many teachers used their own program materials with students?

C. How many teachers have adopted commercial or other teacher prepared programs for use with students?

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[6]Eigen, L. D. "Programming Poses Problems." Phi Delta Kappan. Vol. 44, No. 6, March, 1963. p. 242.

D. For what grade levels and subject areas were materials programmed? Are commercial materials available for the same level and grade?

E. What are the attitudes and opinions expressed by the teachers toward programmed instruction? Are there differences between the experimental and control groups?

F. What financial resources were made available for teachers interested in programmed materials--such as funds for purchase or development?

In short, the objective of the study was to determine the extent of change occurring in the classroom situation of the teacher-programmers.

IV. RELATED RESEARCH

A lengthy review of the literature fails to reveal a single research study in this area. As pointed out in the preceding section on the background to this study, most authorities seem to agree that a teacher should have experience in programming, but there has not been any data to substantiate the claim that a teacher, having become minimally competent in the art of programming, does in fact serve as a change agent in the school setting.

In reviewing the literature, it is possible to find two

studies that have attempted some follow-up on teachers previously trained as programmers. While the purpose of those studies was quite different from the present one, it might be instructive to mention them. Rothkopf[7] sought to learn how effective teacher-programmers might be as evaluators of programmed materials. He concluded that they were singularly ineffective. Because this does, of course, have implications for programming efforts, Markle[8] replicated the study and found a lack of this reported significance among the teacher-programmers she was instructing. In sum, the research is inconclusive, but it tends to raise questions concerning the outcomes of courses on programming for classroom teachers, and to make the present study even more relevant.

VI. PROCEDURES

In the fall semester of 1964, the class registration lists for all of the courses in programming were assembled. Addresses were checked and corrected in as many cases as possible. After eliminating those individuals who had completed the course in programming within the last semester (and who would not have had

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[7]Rothkopf, E. Z. "Some Observations on Predicting Instructional Effectiveness by Simple Inspection." Journal of Programed Instruction. Vol. 2, No. 2. 1963. pp 19-20.

[8]Markle, Susan M. "It Figgers." NSPI Journal. Vol. 4, No. 2. March, 1965. pp 4-5.

an opportunity as yet to put any learnings into practice in their classrooms), we were left with 215 individuals to be surveyed from the programming courses. A second check to remove a few foreign teachers (Canadians were retained in the sample), and survey forms returned due to a lack of forwarding address for individuals who had moved further reduced our final effective sample to 200 programmers.

At this same time, we took a random sample of 70 teachers from the attendance list of the New Directions Institute of the University of Rochester. This is a summer series of meetings devoted to lecture-discussions of new methods and developments in educational practice. The teachers from this sample would serve as our controls since they were known to have been exposed to reports on programmed instruction and to descriptive accounts of its theory and methodology, but had not experienced practice in developing programmed material during the course of the workshops. Addresses were similarly checked, and corrections made as indicated.

Meanwhile, the survey instrument itself (for a copy, see Appendix A) was sent to the Cooperative Research Office, checked, approved and returned. This was now reproduced for distribution.

Mailings to both the study and control groups took place in November of 1964, and in December of 1964 a follow-up mailing was sent to those from whom we had not received a reply. By January 1, 1965, we closed this aspect of the study having received 150 replies from the programmed workshop group (75 percent),

and 46 replies from the control group (66 percent).

Responses to the basic questions dealing with the use of programmed instructional material with classes and with individuals, respectively, were tabulated. (These are questions 1 and 2 on Appendix A). Responses to question 3, Parts A, B, and C, were used as the bases for answering questions regarding the subject-matter areas and grade levels with which programmed instructional materials were being placed to greatest use, and for determining differences in frequency of use of such materials between programming workshop participants and controls.

Responses to question 4 were collected and summarized in order to provide a behavioral indication of activities taking place within the school setting, but outside the classroom *per se*.

The consultant in measurement and statistics, a licensed psychologist familiar with the interpretation of projective protocols, classified each response to question 5 in accordance with the following categories:

A) Highly positive attitude toward programmed instruction;

B) Moderately positive attitude toward programmed instruction;

C) Mildly positive attitude toward programmed instruction;

D) Indefinite attitude toward programmed instruction;

E) Mildly negative attitude toward programmed instruction;

F) Moderately negative attitude toward programmed instruction;

G) Highly negative attitude toward programmed instruction.

A response was classified as ambivalent if it included statements appropriate to category A, B, or C and category E, F, or G.

Responses to question number 6 were screened for direct reference to the programming workshop as a determinant of current attitudes toward programmed instruction. The workshop was considered a determinant if it was mentioned in response to this question, even if it was mentioned in the company of co-determinants. No tabulation of responses to question number 6 by members of the control group was made.

Responses to question number 7 were collected and arrayed for both study and control groups in order to provide an answer as to the types of support given the teacher interested in exploring the medium of programmed instruction.

Responses to question number 8 were used as the basis for estimating attitudinal saliency with respect to programmed instruction. They were classified positive if a generally favorable reference to programmed instruction was made; they were classified negative if the reference was generally unfavorable. They were classified indeterminate if the response mentioned programmed instruction without discernible affect. Since this was an unsolicited, open-ended reaction opportunity, the saliency was maximized.

VII. FINDINGS

With respect to the over-all frequency of reported use of programmed instructional materials, 59 percent of the programming workshop respondents and 22 percent of the control subjects reported some use of programs with classes of students. Also, 53 percent of the programming group and 24 percent of the control group reported the use of programmed materials with individual students. The chi square value exceeds 20 for the former data and 10 for the latter, indicating statistical significance beyond the .01 level in both cases. The graduates of the programmed workshop, then, made significantly greater use of programmed materials in actual teaching situations.

Perhaps a more meaningful figure for comparison, however, lies in the frequency of use of programmed instructional materials with <u>either</u> classes or individual students. Of the respondents from the programming workshop, 75 percent had used programs in one or both of these two ways; 28 percent of the controls had used programs in one or both of these two ways. Using the Chi Square Test indicates a highly significant difference well beyond the .01 level further substantiating the finding that the graduates of the programming workshop made significantly greater use of programmed materials in actual teaching situations.

Reported use of commercial programs, teacher-made programs, and self-constructed programs is summarized in Table 1. The

differences between the programming workshop group and the control group are not statistically significant (although they approach significance at the .05 level) according to the Chi Square Test with respect to the use of commercial or teacher-made programs. On the other hand, there is a highly significant difference between the two groups on the use of self-constructed programs. Teachers who have attended the programming workshop report the use of self-made programs much more frequently than do the control teachers. A Chi Square Value in excess of 77 is obtained indicating a statistical significance well beyond the .01 level.

Table 1.

Use of Programmed Instructional Materials
By Workshop and Control Subjects

		Programming Workshop Respondents	Control Respondents
Use of Commercial Programs	Yes	58	12
	No	92	34
Use of Teacher-Made Programs	Yes	27	3
	No	123	43
Use of Self-Written Programs	Yes	112	2
	No	38	44

Teachers who have been subject to the experience of constructing their own programs, then, are much more likely to employ

these materials with their own students. There is no support, however, for the claim that the experience of programming increases the likelihood of teachers employing commercial programs, or programs prepared by other teachers, with their own students--with statistical significance. (In the latter case, of course, unavailability of other teacher-constructed programs may well be a factor.)

From the standpoint of logical (or practical) significance, however, the issue is not so clear-cut. Appendix B lists the commercial programs used by both programming workshop graduates and control respondents. The 58 programming workshop graduates using them employed a total of 120 commercial programs of varying length and subject-matter. In contrast, the 12 control respondents used only a total of 14 commercial programs. In other words, the programming workshop graduates who used commercial programs at all employed an average of better than two programs apiece while the control respondents averaged only one program apiece.

Similarly, in the matter of non-commercial programs developed by someone other than the user, the three control respondents who reported such use had employed only one program each. The programming workshop graduates who used these non-commercial, other-prepared programs employed them at the rate of almost two per respondent. A summary of the utilization of these programs is shown in Appendix C.

Finally, in the use of self-written programs, the statistically significant difference between the groups is underscored

by the fact that the 112 graduates of the programming workshop who used their own programs actually employed 126 self-written sequences, with a few of the respondents having prepared more than one programmed sequence. On the other hand the two control respondents who had developed their own sequences reported the use and construction of only one sequence each. The units reported by the two groups are arranged in Appendix D.

Question number 4 on the survey form (see Appendix A) asked the respondents to list any professional activities related to programmed learning in which they have engaged. As examples of such activity, we suggested speaking to PTA or teacher groups, conducting in-service workshops, or other non-classroom activites. Of the graduates of the programming workshop, 43 percent had engaged in such activities. Only 13 percent of the control group reported such activities. Use of the Chi Square Test indicates significance beyond the .01 level. Graduates of the programming workshop, then, do engage in professional activities related to programming to a significantly higher extent than do the control respondents.

Approximately half of the programming workshop graduates who did engage in professional activities related to programmed instruction were involved with in-service programs for their colleagues, or with short orientation courses and workshops within their own school setting. Only one of the control group had engaged in this kind of activity; the others primarily reported

giving talks to groups of parents or teachers. Again the logical significance of this may be more important than statistical significance since the programming graduates seem to have been engaged in more activities related to "change processes" than is true of the control respondents.

Table 2 summarizes the results of the attitudinal analysis based upon responses to question number 5 by 132 respondents from the programming workshop and 32 respondents from the control group. Ambivalent responses are tabulated twice in Table 2, accounting for the apparent excess of percentages, and rounding error produces the extra 1 percent in the tabulation for the programming workshop group.

The percentage trend* in Table 2 clearly demonstrates a more favorable attitude toward programmed instruction on the part of the programming workshop group in comparison to that of the controls. It is interesting to note, however, that precisely the same proportion expressed ambivalence in response to question number 5. Chi square based upon unqualified positive and negative responses by respondents from the two groups (83 positive to 15 negative for the programming workshop group; 14 positive to 10 negative for the controls) exceeds 9.6 in value substantiating the statistical significance in expressed attitudes at the .01 level. The graduates of the programming workshop do, in fact, have significantly stronger positive feelings about programmed instruction.

Table 2

Expressed Attitudes Toward
Programmed Instruction

	Programming Workshop		Controls	
	Number	Percent	Number	Percent
Highly Positive	14	11	1	3
Moderately Positive	54	41	6	19
Mildly Positive	48	36	15	47
Indeterminate	6	5	2	6
Mildly Negative	34	26	11	34
Moderately Negative	8	6	5	16
Highly Negative	1	1	0	0
Ambivalent	33	25	8	25

It should be noted, however, that pre-existing favorable dispositions toward programmed instruction may have been important determinants in the original enrollment of members of the programming group in the programming workshops. It would probably be unwise (and certainly improper) to conclude that participation in the programming workshop caused more favorable attitudes to develop. While no causal relationship should be inferred, the correlation still stands that programming workshop graduates had more positive attitudes toward programmed instruction than did the controls.

Thirty-one of the 132 respondents from the programming workshop group who answered question number 5, then went on to question number 6 and specifically mentioned the programming workshop as a determinant of their current attitude toward programmed instruction. There is no reasonable standard against which to judge the significance of this number, but on a subjective basis it might be concluded that when 23 percent of the people expressing some attitude toward a method attribute that attitude, at least in part, to a single experience, then that experience has been of significant influence on attitudinal development. This judgment presupposes, of course, that the individual respondents are capable of objective identification of attitudinal influences.

Question number 7 on the survey form (see Appendix A) asked the respondents to indicate any forms of aid they received through their local institutions (or from other institutions) to assist them in introducing programmed instruction into the classroom. As an example of the kinds of aid they might have received, we suggested the possibility of released time, or reduced teaching load. Only 20 (13 percent) of the programming workshop graduates reported receiving some form of aid. Only 4 (9 percent) of the control group reported receiving some form of aid. The specific forms which this aid took are summarized in Appendix E. While there is no statistically significant difference between the groups in respect to their responses to this question, it may be reasonable to suggest that greater support from either the local or some other

institution may have provided both groups with encouragement for experimentation.

The final question on the survey form (number 8) was an open-ended one inviting the respondents to append any additional comments they might have. Table 3 presents the results of the analysis of responses to the stimulus, additional comments. While some question might reasonably be raised regarding the appropriateness of this approach to estimating attitudinal saliency, there was no compulsion on the part of the respondents to refer to programmed instruction at this point in the questionnaire, and no other attitudinal dimension appears as a likely causal candidate.

Table 3

Unsolicited Attitudinal Expressions
Toward Programmed Instruction

	Programming Workshop		Controls	
	Number	Percent	Number	Percent
Positive Attitude	27	20	8	25
Negative Attitude	7	5	3	9
Indeterminate	18	14	0	0
Ambivalent Attitude	2	2	1	3
No Mention of Programmed Instruction	78	59	20	63

Within the context of a questionnaire focusing upon programmed instruction, whatever might cause respondents to express attitudes in response to an unstructured stimulus does not appear to have been operating in either of the groups to any great extent. Whether this factor qualifies as saliency or not, there is no evidence to indicate that participants in the programming workshop are significantly influenced by it to a greater or lesser degree than the controls.

VIII. CONCLUSIONS

An analysis of the findings obtained in this survey and reported in Section VII suggests the following conclusions:

1. Classroom teachers who have been trained in the programming process make significantly greater use of programmed instructional materials than do teachers who have received only cognitive and descriptive information about programs and programming.
2. Classroom teachers who have been trained in the programming process make significantly greater use of programmed instructional materials for both class and individual instruction than do teachers who have received descriptive information about programs.

3. Classroom teachers who have been trained in the programming process make significantly higher use of self-constructed programs than their peers who have received descriptive information, but do not make significantly greater use of commercial programs or other-teacher prepared materials. (This will be discussed among the implications.)
4. Classroom teachers who have been trained in the programming process engage in significantly more professional activities outside the classroom that are related to informing their peers and the public about programmed instruction.
5. Classroom teachers who have been trained in the programming process have significantly more favorable attitudes toward programmed instruction than do teachers who have received only cognitive and descriptive information about programs and programming.
6. Only a small minority of teachers (whether graduates of a programming workshop or not) are receiving any form of aid or support from their local school, or other institutions, to aid them in applying programs or programming to their classroom teaching.

IX. IMPLICATIONS

While no causal relationship is argued here, the findings and conclusions generally support the contention that teachers who have received training in the construction and development of self-instructional programs are more highly active in the utilization of such materials than are their peers who have learned "about" programs and programming, but have not experienced some training in the construction of a programmed sequence.

Moreover, the activity level of those trained in programming is much higher in those kinds of work that might be generally termed as related to "change processes" in their local institution following their completion of the workshop.

Finally, the significantly higher positive attitudes of these teacher-programmers is of great importance when compared to the attitudes of teachers who have largely "heard about" programs and programming.

Based on the findings disclosed here, there would seem to be a great utility in providing programming workshops for classroom teachers to help them make greater use of this relatively new methodology. Each of the conclusions stated above tends to confirm the hypotheses stated by a number of experts in the field (see references in the section on Background of the Study) who believe that actual involvement in programming is a strong indicator that real change will take place within the classroom.

Perhaps the surprising thing revealed by this study is that so many teachers who had only been exposed to cognitive descriptions of programming and programs have undertaken some use of these materials in their own teaching. There is strong indication, however, that reliance on this approach may well delay the introduction of programmed learning into the majority of American classrooms for a significant period of time.

Obvious in the findings, however, is that a programming workshop is not a panacea. Approximately 25 percent of the programming graduates, for example, did not put their own products into classroom operation. Study and attention should be given to this.

Further study should also be given to the apparent anomaly that the programming graduates did not make significantly higher use of commercial and other-teacher prepared programs. As mentioned in the section on findings, there may well be greater use of <u>other</u> programs than appears on the surface by statistical testing. Another explanation for the lower than expected use of commercial programs might lie in the learnings within the programming workshop itself.

One frequent topic of discussions in the workshops encountered in our experience is that of the inadequacy of many of the commercial programs--particularly many of those that appeared early on the market for sale to the public schools. This particular aspect of the findings should be subjected to further study.

It is a fact that many of the programming graduates use commercial programs; it is also a fact that over half (61 percent) do not. It is important that we find out why this is. One explanation might be that they simply do not wish to use commercial programs, but other possible explanations include: inability to find commercial programs in specific, desired areas; inability to find reliable, valid, and tested commercial programs in desired areas; or general suspicion, perhaps, of all commercial programs.

Another area of difficulty that requires further study is that of aid and support for teachers interested in using programmed instruction. Only a small percentage of the individuals in this study were found to have received some assistance in their efforts to use programmed materials. While a follow-up on this aspect is beyond the limits of the study, it is important to point out that no change process is going to enjoy success without greater support than has been characterized in these findings.

Appendix A

Survey Questionnaire Employed in this Study

Name _____ Sex M F

Marital Status _____

Years of Teaching Experience _____

Subject(s) Specialization _____

_____

Grade(s) Taught _____

_____

1. Have you ever employed auto-instructional materials (teaching-machines, programs, programmed texts, etc.) with any of your classes?

   Yes _____ No _____

2. Have you ever employed auto-instructional materials with individual pupils?

   Yes _____ No _____

3. If you answered "yes" to <u>either</u> 1 or 2, please complete the following:

   List the titles and publisher of all those commercially programmed instructional units that you have used.

Title	Grade Level	Length of Instructional Time Covered

List the titles of any non-commercial, teacher-prepared programmed instructional units that you have used in teaching, but which were prepared by someone other than yourself.

Title	Grade Level	Length of Instructional Time Covered

List the titles of any programmed learning units that you have personally prepared.

Title	Grade Level	Length of Instructional Time Covered

4. Please list any professional activities related to programmed learning, other than teaching, in which you are now, or have been engaged. (E.g., speaking to PTA or similar groups on the topic, conducting in-service classes or workshops in programming for teachers, etc.)

5. In a few sentences, please state your candid opinion regarding the current value of programmed instruction and its future potential.

6. Was there any particular incident or experience that caused you to begin to develop the opinion expressed above? If so, please describe it briefly and approximate the date when it took place.

7. Would you describe briefly any financial or other support (released time, reduced teaching load) that is available in your school for teachers who would like to introduce programmed materials into their classroom.

8. **Additional Comments:**

_____

_____

_____

_____

_____

_____

Appendix B

Commercial Programs Utilized By Respondents to the Survey

Title/Publisher	Mentioned Uses By Program Workshop	Controls	Grade Level
Language Arts			
Time Telling (Graflex)	3	0	2
Programmed Reading (McGraw-Hill)	7	1	2-3
Use of Dictionary Guide Words (Graflex)	3	0	4
Spelling Rules (Teaching Materials Corp.)	5	0	4-6
Reading (Science Research Assoc.)	3	2	5
Proper Punctuation (Doubleday)	2	0	5
English 2600 (Harcourt Brace)	5	3	5-9
Study Skills (Honor Products)	2	0	7-9
English 3200 (Harcourt Brace)	1	1	9
Improving Written Communications (Lord Products)	1	0	Adult
Mathematics			
Elementary Arithmetic Series: Addition and Subtraction (Teaching Materials Corp.)	2	0	3

Title/Publisher	Mentioned Uses By Program	Workshop	Controls	Grade Level
Elementary Arithmetic Series: Multiplication & Division (Teaching Materials Corp.)	2		0	3
Elementary Arithmetic Series: Fractions (Teaching Materials Corp.)	1		0	3
Mathematics Enrichment (Harcourt Brace)	7		1	3-5
Addition of Like Fractions (Graflex)	2		0	5
Perimeters (Graflex)	1		0	5
Introduction to Probability (Graflex)	1		0	5
What Are The Chances (Macmillan)	1		0	5
Number Bases and Binary Arith. (Coronet)	1		1	5
Introduction to Sets (Holt, Rinehart, Winston)	2			7
Fundamentals of Algebra (Teaching Materials Corp.)	2		2	9
Algebra (Temac)	4		1	9
Plane Geometry (Temac)	2		0	10
Review of Algebra (Wiley)	1		0	10
Intermediate Algebra (Temac)	3		0	11
Introduction to Descriptive Statistics (Temac)	2		0	College

Title/Publisher	Mentioned Uses By Program Workshop	Controls	Grade Level
Slide Rule (Doubleday)	1	0	Adult
Self-Teach Arithmetic (Scholastic Magazines)	1	0	-
Bases and Numerals (Macmillan)	2	0	-
Science			
How We Forecast Weather (Coronet)	1	0	5
What is a Mammal (Coronet)	1	0	5
Introduction to Entomology (Graflex)	3	0	5-6
Life Cycle of Insects (Graflex)	4	0	5-7
Using Clouds (Graflex)	4	0	5-7
Earth-Sun Relations (Ginn)	4	0	6-8
Classification of Plants (Graflex)	2	0	7
Identification of Trees (Graflex)	1	0	7
Our Solar System (Coronet)	3	1	7
Our Earth and the Universe (Graflex)	2	0	9
Shaping the Earth's Surface (Graflex)	1	0	9
Atomic Structure and Bonding (Basic Systems)	2	0	10-12

Title/Publisher	Mentioned Uses By Program Workshop	Controls	Grade Level
Mole Concept (Graflex)	3	0	10-12
Avogadros-Number (Graflex)	1	0	11
Gas Laws (Holt-Rinehart-Winston)	1	0	11
Kinetic-Molecular Theory of Gases (Holt-Rinehart-Winston)	1	0	11
Principles of Chemistry (Addison-Wesley)	1	0	11
Gas Laws (Harper & Row)	1	0	11
Asexual Reproduction (Graflex)	1	0	12
Exponential Notation (Freeman)	1	0	12
Program Supplement for General Chemistry (Benjamin)	1	0	12
General Chemistry (Wiley)	1	0	12
Programmed Genetics (Heath)	1	0	College
Medical Parasitology (Appleton-Century-Crofts)	0	1	College
Introduction to Electronics (Doubleday)	1	0	Adult
Basic Electricity (McGraw Hill)	1	0	Adult

Title/Publisher	Mentioned Uses By Program Workshop	Controls	Grade Level
Social Studies			
The Constitution (Ginn & Co.)	1	0	11
Miscellaneous			
Introduction to Color Concepts (Graflex)	2	0	4-6
Bank Teller's Job (EMI)	1	0	Adult
Cutting Costs (Lord Products)	1	0	Adult
Introduction to Asepsis (Columbia University)	2	0	College
Total Utilization	120	14	

Appendix C

Summary of Teacher Use of Non-Commercial, Other-Teacher Constructed Programs

Area	Uses by Programmers	Uses by Controls
Language Arts	5	1
Mathematics	6	1
Science	17	1
Social Studies	9	0
Miscellaneous	10	0
Total	47	3

Appendix D

Self-Constructed Programs Used By Respondents to the Survey

Title	Constructed By Program	Constructed By Workshop	Constructed By Controls	Grade Level
Language Arts				
Spelling		x		2
Consonant and vowels		x		2
Word meanings		x		2
Spelling		x		3
Homonyms, antonyms, synonyms		x		4
Direct quotations		x		4
Dictionary usage		x		4-5
Card catalog		x		4-5
Syllables		x		4-6
Spelling		x		5
Homonyms, antonyms, synonyms		x		5
Sentence		x		5
Capitalization		x		5
Verbs		x		5
Homonyms, antonyms, synonyms		x		5-6
Modifiers		x		5-8
Spelling		x		6
Sentence diagramming		x		6
Verbs		x		7
Subject, predicate		x		7
The partitive		x		9-10
Manuscript - Cursive Handwriting		x		College
Handwriting in elementary school		x		College
Grammar review		x		Adult
Rhetoric review		x		Adult
Letterwriting		x		Adult
Mathematics				
Money		x		1
Algebra		x		2
Telling time		x		2
Fractions		x		4
Perimeter		x		5
Fractions		x		5
Problem solving		x		6

Title	Constructed By Program Workshop	Constructed By Controls	Grade Level
Trignometric ratios	x		6-7
Percent	x		7
Measurement	x		7
Exponents	x		7
Division of fraction	x		7-8
Metric system	x		7-8
Directed numbers	x		7-8
Probability	x		8-9
Exponents	x		9
Equations	x		9
Signed numbers	x		9
Measurements	x		9
Signed numbers	x		9
Inequalities	x		10
Ratio and proportion for geometry	x		10
Triangle	x		10
Applied ratio and proportion	x		10
Simple locus	x		10
Square root	x		10-12
Exponents	x		11
Trigonometry	x		11
Algebra	x		College
Rational and irrational numbers	x		College
Approximate numbers	x		College
Science			
Reptiles	x		4
Simple machines	x		4
Mammals	x		4
Simple machines	x		5
Weather	x		5
Light	x		5-6
Animal classification	x		5-6
Entomology	x		5-7
Magnetism	x		5-8
Simple machines	x		6
Magnetism	x		6
Simple machines (levers)	x		6
Entomology	x		6-7
Classification of plants	x		7
Cell	x		7
Matter, molecules, atoms	x		7
Matter	x		7
Chemistry of air	x		7

Title	Constructed By Program	Workshop	Controls	Grade Level
Chemistry of fire	x			7
Chemistry of water	x			7
Genetics	x			8
Universe	x			8
Shaping of the earth's surface	x			9
Universe	x			9
Meiosis	x			10
Mitosis	x			10
Anatomy of sex	x			10
Entomology			x	10
Atomic theory	x			10-12
Asexual reproduction of plants	x			10-12
Balancing formula equations	x			11-12
Mole concept	x			11-12
Avogadros number	x			11-12
Physics: unit analysis	x			11-12
Atomic theory	x			College
Social Studies				
Story of man			x	2
Map reading	x			4
Latitude	x			5
Geography of South America	x			5
Longitude	x			6
Revolutionary war	x			8
Latitude	x			9
Map reading	x			9
Constitution	x			11
Bill becomes a law	x			11
Tariffs	x			11
Bill of rights	x			11
Miscellaneous				
Industrial training				
Lathe operation	x			9-12
Reading micrometer	x			10-12
Diffusion pump	x			12
Four stroke cycle	x			Adult
Carburetor	x			Adult
Business				
Filing rules	x			11
Balance sheet terminology	x			11-12

Title	Constructed By Program	Constructed By Workshop	Constructed By Controls	Grade Level
Bond investment		x		11-12
Filing rules		x		12
Language				
Spanish		x		9
French		x		9-10
Latin		x		9-11
Spanish		x		10-12
Teaching colors		x		Pre-school deaf
Elementary color		x		4-6
Rehabilitation for stroke victims		x		~~5-6~~ College
Introduction to radiation therapy		x		College
Religious education		x		Adult
Textiles - application of colors		x		College
UAL city codes		x		Adult
X-ray physics		x		Adult
Aircraft maintenance		x		Adult
X-Omat system		x		Adult
Aircraft repair		x		Adult
Total Units Constructed		126	2	

Appendix E

Summary of Aid Received by Respondents in Furthering the Use of Programs in Their Classrooms

Form of Aid	Programming Workshop	Control
Financial support for course work or tuition	4	1
Summer assignment at pay to work on programs	2	1
Relieved of some classroom assignments	2	1
Assigned to work specifically on programs	3	1
Grants from State Department of Education	1	0
Grants from Federal Sources	2	0
Grants from Local College Funds	1	0
Funds provided for purchase of programs	5	0
Total Instances of Aid	20	4

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Additional Suggested Readings

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